DUAL PORT USB INTERFACE

RELATED APPLICATIONS

The present invention is related to co-pending U.S. patent application, entitled

MEMORY CARD SOCKET USING A DUAL-PORT USB CONNECTOR, serial no.

_____ (2812P), filed on even date herewith, and assigned to the assignee of the present

invention.

FIELD OF THE INVENTION

The present invention relates generally to computer systems and particularly to a

universal serial bus for computer systems.

BACKGROUND OF THE INVENTION

A universal serial bus (USB) bus is an electronic network specification designed to

allow a personal computer (PC) to be connected to multiple electronic devices such as

keyboards, mice, personal data assistants (PDA's), cameras, music players and printers. The

USB bus supports a host-peripheral relationship between connected devices as opposed to a

peer-to-peer relationship. A typical USB electronic network 10 is shown in Figure 1. The

personal computer is always designated as the host device and the PC connected devices are

always designated as the peripheral devices. Stated in terms of logical topology, USB

networks exhibit a one-to-many relationship as opposed to a one-to-one relationship; the PC

being "one" and the peripheral devices the "many". Because the USB specification includes

no more than one host in any USB connected network, current USB connectors and cables

make no physical distinction between the host connectors and the peripheral connectors. Thus, an underlying assumption of USB networks is that the user of the network can easily distinguish between a host device and a peripheral device.

However, it is easy to select three common devices such as a PC, a PDA that is an intelligent portable computer, and a USB peripheral such as a printer in which the lack of gender of the USB connector can cause significant confusion. Figure 2 illustrates the problem of one USB host 20 connected to a plurality of peripherals 22 and 24. As is shown in Figure 2, suppose a user wishes to connect the PC 20 to the PDA 22. In this case, the PDA 22 is a USB peripheral and its USB signals must respond as a USB peripheral device 20 and be handled by USB peripheral software drivers and USB peripheral interface logic. Now suppose the user wishes to connect the PDA 22 to a USB printer. In this case the PDA 22 must be a USB host and its USB signals must respond as a USB 20 host and be handled by USB host software drivers and USB host interface logic. The inability of the PDA 22 to know how its USB signals should be treated is caused by the lack of host/peripheral gender of the USB connector and the basic one-to-many relationship of the USB network.

A new initiative called USB on-the-go (OTG) is an attempt to provide a solution to the problem of designating which end of the USB cable is a host or a peripheral. OTG does this by adding new software to the USB enumeration layer and defining a new USB fifth pin labeled VDIR to the four standard USB pin definitions of D+, D-, VCC and GND. The OTG effort does solve the USB connector gender problem but at the expense of added software, new types of cables and connectors, and a new pin definition VDIR. What is needed is a system and method to overcome the above-identified problems. The present invention addresses this need.

SUMMARY OF THE INVENTION

A dual port USB interface is disclosed. The dual port interface comprises a USB host port and a USB peripheral port. The host port and the peripheral port are defined using predetermined signals. In a preferred embodiment the dual port USB interface is utilized in a network where at least one dual port USB (DPUSB) connector is connected to either standard USB connectors or other DPUSB connectors. By use of the DPUSB interface, a single device in a network can act as both a host or a peripheral to other devices as well create network peer-to-peer relationships. Use of DPUSB connectors also provides the opportunity of new types of devices such as memory cards and cables that will greatly increase the ease of use of many intelligent electronic devices such as cameras and PDA's.

BRIEF DESCRIPTION OF THE DRAWINGS

Figure 1 illustrates a typical USB network.

Figure 2 illustrates the problem of one USB host connected to a plurality of peripherals.

Figure 3 illustrates a DPUSB connector and cable solution in accordance with the present invention.

Figure 4 illustrates connecting two devices with DPUSB connectors and both host and peripheral active ports.

Figure 5 illustrates DPUSB connectors creating a USB peer-to-peer network.

Figure 6 illustrates typical multiple connections and connectors now required for cameras and PCs.

Figure 7 illustrates DPUSB connectors creating new device connections.

Figure 8 illustrates DPUSB connectors eliminating multiple types of I/O ports using

suitable DPUSB cables.

DETAILED DESCRIPTION

The following description is presented to enable one of ordinary skill in the art to make

5   and use the invention and is provided in the context of a patent application and its

requirements. Various modifications to the preferred embodiment and the generic principles

and features described herein will be readily apparent to those skilled in the art. Thus, the

present invention is not intended to be limited to the embodiment shown but is to be accorded

the widest scope consistent with the principles and features described herein.

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The Dual Port USB Solution

The confusion of the host/peripheral assignment inherent in a standard USB connection

is caused by the one-to-many topology of the USB network and the USB connector pins

definitions. However, there is no host/peripheral confusion existing in the USB software

15   driver or in the USB interface electronics that couple the system CPU to the USB port. Figure

3 illustrates the DPUSB connector and cable connection solution 100 in accordance with the

present invention. Therefore, an elegant solution to the problem is to create a new USB

interface having both a host and a peripheral port in the same connector (Figure 3) which we

designate as a dual port USB (DPUSB) connector 100.

20   The default signals in the DPUSB interface are D+H, D-H, D+P, D-P, GNDH,

GNDP, +5VH, and +5VP. The D+H and D-H are the host differential data lines. The D+P

and D-P are the peripheral differential data lines. The GNDH and +5VH are the host power

lines. And the GNDP and +5VP are the peripheral power lines.

Other pin assignments are possible which combine the GND pins or eliminate one of the

VCC pins. It is also possible to add additional pins to take care of special functions of a USB

device such as device detect pins and memory write protect pins. This is only a brief listing of

optional added function pins, as many other possibilities exist. However, what distinguishes a

DPUSB interface from some other combination of possible modified USB connections is that

on every DPUSB connector both the host and peripheral data ports are defined using the

signals D+H, D-H, and D+P, D-P.

DPUSB and Existing USB Connectors

The DPUSB connector100 retrofits easily with current USB connectors (Figure 3)

using a suitable DPUSB to USB cable. A simple color code and symbol label at the DPUSB

cable end can identify whether the host or peripheral ports are connected. Optionally, since

there are equal number of pins assigned to both the host and peripheral ports, it is possible to

design a DPUSB connector that allows a reversal of the DPUSB plug to connect either the host

or peripheral ports.

DPUSB to DPUSB Connections

If two or more USB devices with DPUSB connectors also have active host and

peripheral circuitry and software, then the two devices can communicate together through two

channels at the same time. This can be useful using today's multiprocessing, interrupt driven

operating systems and their complex applications. This topology of multiple host/peripheral

connections creates a pseudo peer-to-peer relationship between the two devices as shown in

Figure 4 and Figure 5. Figure 4 illustrates connecting two devices 200a and 200b with DPUSB

connectors 100 and both host and peripheral active ports. Figure 5 illustrates DPUSB

connectors 100a-100c creating a USB peer-to-peer network.

New Devices Created with DPUSB Connectors

5   Another use of DPUSB connectors is the elimination of multiple types of I/O

connections in devices such as cameras. Figure 6 illustrates multiple connections and

connectors conventionally required for a camera 304 and a PC 306. For example, consider

three devices such as a PC, a digital camera, and a memory card. Since digital cameras require

a connection to both a PC and a memory card, they are normally made with two physical I/O

10   ports: namely one for connection to the PC and one for connection to the memory card as in

Figure 5. Also, since PCs sometimes require connection to the camera and/or the memory

card, the PC may also require both types of connectors. Figure 7 illustrates DPUSB connectors

creating new device connections. If the camera 406 and the memory card 404b are both built

with DPUSB connectors, the camera only needs one physical I/O port as seen in Figure 7.

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With suitably designed DPUSB connectors and DPUSB cables, the connections of camera-to-

memory card; PC-to-memory card, PC-to-camera-to-memory card can all be easily done

(Figure 8). Figure 8 illustrates DPUSB connectors 100 eliminating multiple types of I/O ports

using suitable DPUSB cables.

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Conclusion

The DPUSB interface solves the connection ambiguities that have arisen using

standard USB connectors and cables. Connectors using the DPUSB interface also provide the

means for new types of application software to be written by allowing both host and peripheral driver functions to reside on both sides of every DPUSB-to-DPUSB connection. And DPUSB connectors provide these added benefits without requiring any new USB functional pin definitions in standard USB connectors or new USB software driver definitions or hardware

5   driver definitions. Use of the DPUSB interface also provides the opportunity of new types of devices such as memory cards and cables that will greatly increase the ease of use of many intelligent electronic devices such as cameras and PDA's.

Although the present invention has been described in accordance with the embodiments shown, one of ordinary skill in the art will readily recognize that there could be

10   variations to the embodiments and those variations would be within the spirit and scope of the present invention. Accordingly, many modifications may be made by one of ordinary skill in the art without departing from the spirit and scope of the appended claims.